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EXAMINER	
KRETZMER, ERIKA A	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/522,445	ABERG ET AL.	
	Examiner	Art Unit	
	Erika Kretzmer	2192	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 January 2005 and 20 September 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 January 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *1/19/2005*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Status of Claims

1. This action is in reply to the application filed on 1/19/2005 and 9/20/2005. Claims 1-20 are currently pending and have been examined. Application claims priority to provisional application (number 60-403,210) filed on 8/12/2002. Application is a national stage entry of PCT application 03/06764 with international filing date 6/27/2003 and international priority date 8/2/2002.

Drawings

2. Original drawings 1-7 were received on 1/19/2005. Drawings 1-7 are accepted.

Claim Rejections - 35 USC § 101

3. 35 U.S.C. §101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

4. Claims 13, 15, and 19 are rejected under 35 U.S.C. §101 because they are not directed to statutory subject matter.

5. Claims 13 and 15 are drawn to a <u>*computer program*</u> *comprising program code means for performing all the steps of* the prior claim *when said program is run on a computer*. A *computer program per se* is not a physical thing. It is neither a computer component nor a statutory process. Such claimed computer programs do not define any structural and functional interrelationships between the computer program and other claimed elements of a computer which would permit the computer program's functionality to be realized. In contrast, a claimed computer-readable medium encoded with a computer program is a computer element which defines structural and functional interrelationships between the computer program and the rest of

the computer which permit the computer program's functionality to be realized, and is thus statutory. See *Lowry*, 32 F.3d at 1583-84, 32 USPQ2d at 1035. Although claims 13 and 15 recite that the computer program can *run on a computer*, the claim is not directed towards a method or system involving a computer. The claim is rejected as being directed towards non-statutory material.

6. Claim 19 is directed to *a data record comprising a compressed intermediate representation of an input code*. A *data record* is a data structure. Data structures not claimed as embodied in computer-readable media are descriptive material *per se* and are not statutory because they are not capable of causing functional change in the computer. See, e.g., *Warmerdam*, 33 F.3d at 1361, 31 USPQ2d at 1760 (claim to a data structure *per se* held nonstatutory). Such claimed data structures do not define any structural and functional interrelationships between the data structure and other claimed aspects of the invention which permit the data structure's functionality to be realized. In contrast, a claimed computer-readable medium encoded with a data structure defines structural and functional interrelationships between the data structure and the computer software and hardware components which permit the data structure's functionality to be realized, and is thus statutory. Claim 19 does not include such a tangible computer-readable medium and is rejected as being directed to non-statutory material.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. §103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 1-19 are rejected under 35 U.S.C. §103(a) as being unpatentable over Cyran et al. (EP 0943990 A), hereafter Cyran, in view of "Automatic Inference of Models for Statistical Code Compression" (Fraser, 1999).

Claim 1

Cyran teaches *a method of generating executable program code for a data processing system* (see figure 1), comprising *an encoding stage* (performed by the "code preparation system 12", see figure 1 and page 2 line 33) *for generating a compressed intermediate representation (E-IR)* (see figure 1, "extended class file 14") o*f an input code (IC)* (see figure 1, "input code 11"). Cyran teaches that the *encoding stage* further comprises:

- *transforming (301) the input code including performing a selected set of code optimisation steps* (see at least page 3, lines 7-10: "the present invention is a code preparation system 12 which accepts as input pre-processed code 11, analyzes the results, and then provides a code interpretive runtime environment ... with optimization information, hints and/or directions (collectively referred to as 'optimization information') to use in further processing of the intermediate code") *resulting in transformed code (302)* (intermediate code) *and compiler information (303) about the transformed code* (see for example page 3, lines 12-13: "optimization information" in the form of "additional attributes added to class files 14")

Cyran also teaches *a decoding stage for generating the executable program code from the compressed intermediate representation* (see at least figure 1, "code interpretive runtime environment" and page 2 lines 38-39: "The code interpretive runtime environment is operable to use the instructions to further process the intermediate code on the first data processing platform"). Cyran teaches that the *decoding stage* further comprises:

- *further compiling (407) the transformed code using the decoded compiler information and resulting in the executable program code (EXE)* (see at least page 3, lines 15-17: by further processing in accordance with the optimization information provided by the code

preparation system 12, the code interpretive runtime environment is able to execute the intermediate code mode efficiently…")

Cyran does not explicitly teach that the *encoding stage* comprises a *statistical model* that is used to *encode the transformed code and the compiler information to form the compressed intermediate representation*. Likewise, although Cyran teaches decoding an intermediate representation, Cyran does not explicitly teach that the *decoding stage* comprises *decoding the* *compressed* *intermediate representation* (that is, the intermediate representation encoded with the statistical information).

However, Fraser teaches a method of compressing computer programs, and in particular of intermediate representations. Frasier teaches that state information (e.g. the last few tokens seen, stack height, datatype of the top few stack elements, see page 243 section "IR predictors") and statistical information (a decision tree is generated and a probability distributed to each leaf, see page 243 section "Background: Machine learning of decision trees") is extracted from the transformed code and the compiler information. Frasier further teaches that the extracted state information and statistical information are used to encode the transformed code and compiler information, resulting in a compressed intermediate representation (see at least page 242, "Motivation": "This papers principal focus is ... the more basic problem of statistical models that reduce entropy, because such models lead directly to a variety of compact encodings"). Frasier further teaches that the compressed intermediate representation is decoded resulting in the transformed code and the compiler information (see at least page 242, "Motivation": "saving even a few percent in size frees up more than enough resources to implement the decompressor").

It would have been obvious to one of ordinary skill in the art to combine the intermediate representation in a limited resource computing environment of Cyran with the statistical code compression of Fraser because it would reduce the size of the representation (see at least Frasier, page 242, "Motivation").

Claim 2

Claim 2 includes all of the limitations of claim 1. Cyran teaches *the encoding stage is performed on a first data processing system* (see at least page 3, lines 13-15: “a resource rich computing environment”), and *the decoding stage is performed on a second data processing system* (see at least page 3, lines 15-17: “a limited resource computing environment”). Cyran further teaches *transferring the compressed intermediate representation from the first data processing system to the second data processing system* (see at least Figure 1 and page 3, lines 7-10: "provides a code interpretive runtime environment ... with optimization information, hints, and/or directions ... to use in further processing of the intermediate code").

Claim 3

Claim 3 includes all of the limitations of claims 1 or 2. Cyran does not teach generating state information and statistical information. Frasier teaches *generating the state information and statistical information further comprises obtaining state information* (the computed predictors mentioned on page 243, section “IR Predictors”) *from a state machine* (see at least page 243, section “IR Predictors”: “Markov model”) *based on the transformed code and the compiler information* (see at least page 243, section “IR Predictors”: “IR code is full of material that can help predict what’s coming next”). The predictors being tracked with every new token read, as with a Markov model, implies that a state machine is present. Frasier further teaches that; Frazier further teaches *obtaining probability information* (see at least page 243) *from a statistical model* (“decision tree”) *based on the obtained state information* (“predictors”, see at least page 243, section “IR Predictors”: predictors are proposed, and a machine-learning algorithm is used “to identify the predictors and contexts that prove useful"). It would have been obvious to one of ordinary skill in the art to combine the intermediate representation of Cyran with the statistical code compression of Fraser because it would reduce the size of the representation on a handheld computer (see at least Frasier, page 242, "Motivation").

Claim 4

Claim 4 includes all of the limitations of claim 3. Cyran does not teach a state machine. Frasier teaches *the state machine comprises a syntactic model of at least one of the transformed code and the compiler information* (see at least page 243 section "IR Predictors": "'Markov" predictors capture idioms such as the compare-branch and add-1 patterns above.") The "idioms" described by Frazier are a syntactic model because they are a function of the preceding symbols from the compiled data stream. It would have been obvious to one of ordinary skill in the art to combine the intermediate representation of Cyran with the statistical code compression of Fraser because it would reduce the size of the representation on a handheld computer (see at least Frasier, page 242, "Motivation").

Claim 5

Claim 5 includes all of the limitations of claims 3 or 4. Cyran does not teach a state machine. Frasier teaches *the state machine comprises an execution model of the transformed code* (see at least page 243 section "IR Predictors": "stack-height ... Computed predictors encode domain-specific knowledge that is not explicitly available to general-purpose compressors"). Domain-specific knowledge such as stack-height is an execution model because it models the behavior of the code during execution. It would have been obvious to one of ordinary skill in the art to combine the intermediate representation of Cyran with the statistical code compression of Fraser because it would reduce the size of the representation on a handheld computer (see at least Frasier, page 242, "Motivation").

Claim 6

Claim 6 includes all of the limitations of any one of claims 3 through 5. Cyran does not teach a state machine. Frasier teaches *the state machine comprises a model of the compiler information* (see at least page 243 section "IR Predictors": "Computed predictors such as the stack height ... and datatype"). The computed predictors are compiler information because they contain

information that has no direct impact on the correctness of reconstructed executable code (see specification page 3 line 30 though page 4 line 14, particularly "high-level language data types"). It would have been obvious to one of ordinary skill in the art to combine the intermediate representation of Cyran with the statistical code compression of Fraser because it would reduce the size of the representation on a handheld computer (see at least Frasier, page 242, "Motivation").

Claim 7

Claim 7 includes all of the limitations of any one of claims 1 through 6. Cyran teaches *storing the intermediate representation* of the code (see at least page 6, lines 10-14: "The generation of the optimization information ... is performed ahead-of-time. The code preparation system operates ... irrespective of time ...). Cyran further teaches *performing the decoding stage in connection with a subsequent execution of the generated executable program code* (see at least page 6, lines 8-10: "optimization information … is provided to the JIT compiler … which … is operable to generate native code in accordance with this optimization information ").

Cyran does not teach that the <u>compressed</u> intermediate representation is stored. Frasier teaches transmitting compressed intermediate representations and loading them from disk (see at least page 242, "Motivation"). It would have been obvious to one of ordinary skill in the art to combine the intermediate representation of Cyran with the statistical code compression of Fraser because it would reduce the size of the representation on a handheld computer (see at least Frasier, page 242, "Motivation").

Claim 8

Claim 8 includes all of the limitations of any one of claims 1 through 7. Cyran teaches *the step of further compiling the transformed code further comprises further optimising the resulting executable code* (see at least page 3, lines 15-18, particularly: "the code interpretive runtime environment is able to execute the intermediate code more efficiently").

Claim 9

Claim 9 includes all of the limitations of any one of claims 1 through 8. Cyran teaches *the input code comprises Java bytecode* (see at least page 3, lines 19-22: "the input code is Java source code or bytecodes").

Claim 10

Claim 10 includes all of the limitations of any one of claims 1 through 9. Cyran teaches *the data processing system is a mobile terminal* (see at least page 3, lines 15-18 "digital personal assistant"). A digital personal assistant would be understood by one of ordinary skill in the art to be a mobile device or terminal.

Claim 11

Claim 11 includes all of the limitations of any one of claims 1 through 9. Cyran teaches *the transformed code comprises a number of code elements* (see at least page 3, lines 19-23, "Java bytecodes"). Cyran does not teach a probability distribution of said code elements.

Frazier teaches *determining a probability distribution of said code elements* (see page 243, "Background: Machine learning of decision trees", particularly "a probability distribution that suits the context defined by those tests"). Frasier further teaches *providing the determined probability distribution to the step of generating statistical information* (see at least page 243, "Background: Machine learning of decision trees", particularly the example starting in the first paragraph of column 2).

Claim 12

Claim 12 is distinguished from claim 1 because claim 12 does not require the program code to be <u>executable</u>. The other features of claim 12 correspond to the features of claim 1. Claim 12 is rejected as obvious over a combination of Cyran and Frazier by the same reasoning as presented for claim 1.

Claim 13

Claim 13 is distinguished from claim 12 because it includes “means for performing all the steps ... when said program is run on a computer”. Cyran teaches that the method is implemented on a computer (see at least figure 2, “central processing unit”).

Claim 13 is not interpreted under 35 USC 112, sixth paragraph. Although claim 13 contains the phrase "means for", and are thus presumed to invoke USC 112 sixth paragraph, the means are modified by the structures of a *computer* and *program code*, which are sufficient structure acts to the specified function.

Claim 14

The features of claim 14 correspond to the features of claim 1, except that claim 14 is directed only to performing the decoding stage steps on the limited-memory device. Cyran teaches performing the decoding stage steps on the limited-memory device (see at least page 3, lines 15-18 “digital personal assistant”). The remaining limitations of claim 14 are rejected as obvious over a combination of Cyran and Frazier by the same reasoning as presented for claim 1.

Claim 15

Claim 15 is distinguished from claim 14 because it includes “means for performing all the steps ... when said program is run on a computer”. Cyran teaches that the method is implemented on a computer (see at least figure 2, “central processing unit”).

Claim 15 is not interpreted under 35 USC 112, sixth paragraph. Although claim 15 contains the phrase "means for", and are thus presumed to invoke USC 112 sixth paragraph, the means are modified by the structures of a *computer* and *program code*, which are sufficient structure acts to the specified function.

Claim 16

Claim 16 is directed to a system which performs the method described in claim 1. The system of claim 16 includes a first compiler in the encoding module and a second compiler in the decoding module. Cyran teaches a first compiler in the encoding module (see at least figure 1, part 12 “code preparation system”) and a second compiler in the decoding module (see at least figure 1, "interpretive runtime environment"). The remaining limitations of claim 16 are rejected as obvious over a combination of Cyran and Frazier by the same reasoning as presented for claim 1.

Claim 17

Claim 17 is directed to an encoding device which has the same features of the system of claim 16. The features of the encoding device of claim 17 are thus rejected as obvious over a combination of Cyran and Frazier by the same reasoning as presented for claim 17.

Claim 18

Claim 18 is directed to a system which performs the method described in claim 14. Claim 18 is thus rejected as obvious over a combination of Cyran and Frazier by the same reasoning as presented for claim 14.

Claim 19

Claim 19 is directed to a data record comprising a compressed intermediate representation as created in the method of claim 1. Claim 19 is thus rejected as obvious over a combination of Cyran and Frazier by the same reasoning as presented for claim 1.

Cited Prior Art

9. Fraser (US 6,516,305 B1), Henkel et al. (US 6,691,305 B1), and Henkel et al. (US 6,732,256 B2) are cited as being of relevance to the claims and to the disclosed subject matter as a whole.

10. **Examiner's Note**: The Examiner has pointed out particular references contained in the prior art of record within the body of this action for the convenience of the Applicant. Although the specified citations are representative of the teachings in the art and are applied to the specific limitations within the individual claim, other passages and figures may apply. Applicant, in preparing the response, should consider fully the entire reference as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner.

Conclusion

11. Any inquiry of a general nature or relating to the status of this application or concerning this communication or earlier communications from the Examiner should be directed to **Erika Kretzmer** whose telephone number is **(571) 270-5554.** The Examiner can normally be reached Monday through Thursday, 9:30am-6:00pm Eastern Time. If attempts to reach the examiner are unsuccessful, the Examiner's supervisor, **Tuan Dam** can be reached at **(571) 272-3695**.

12. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://portal.uspto.gov/external/portal/pair . Please direct questions on access to the Private PAIR system to the Electronic Business Center (EBC) at **866.217.9197** (toll-free).

13. Any response to this action should be mailed to:

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or faxed to 571-273-8300. Hand delivered responses should be brought to the United States Patent and Trademark Office Customer Service Window:

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/Erika Kretzmer/

Examiner, Art Unit 2192

July 8, 2009

/Tuan Q. Dam/

Supervisory Patent Examiner, Art Unit 2192